

Beam Power Tube

LESS THAN 1-SECOND WARM-UP
FOR USE IN LOW-VOLTAGE MOBILE
EQUIPMENT UP TO 500 Mc

COAXIAL-ELECTRODE STRUCTURE
CERAMIC-METAL SEALS
CONDUCTION COOLED

For Use as an RF Power Amplifier, Oscillator, Regulator, Distributed Amplifier, or Linear RF Power Amplifier in Mobile or Stationary Equipment

Electrical:

Filamentary Cathode, Woven-Wire-

Mesh Type, Oxide-Coated:

Voltage (AC or DC) 2.9 volts

Current at 2.9 volts. 4.6 amp

Minimum heating time. less than 1^a sec

Mu-Factor, Grid No.2 to Grid No.1

for plate volts = 250, grid-No.2

volts = 200, and plate amperes = 1.2 11

Direct Interelectrode Capacitances:^b

Grid No.1 to plate. 0.13 max. pf

Grid No.1 to cathode. 16 pf

Plate to cathode. 0.03 max. pf

Grid No.1 to grid No.2. 22 pf

Grid No.2 to plate. 7 pf

Grid No.2 to cathode. 3 pf

Mechanical:

Operating Position. Any

Maximum Overall Length. 2.26"

Seated Length 1.920" ± 0.065"

Diameter. 1.426" ± 0.010"

Weight (Approx.). 2 oz

Socket. E. F. Johnson Co.^c No.124-311-100,

Mycalex^d No.CP464-2, or equivalent

Grid-No.2 Bypass Capacitor. .E. F. Johnson Co.^c No.124-113-1,

or equivalent

Base. Large-Wafer Elevenar 11-Pin with Ring

(JEDEC No.E11-81)

Terminal Connections (See Dimensional Outline):

BOTTOM VIEW

Pin 1 - Filament-Cathode

Pin 2 - Grid No.2

Pin 3 - Grid No.1

Pin 4 - Same as Pin 1

Pin 5 - No Internal Connection

Pin 6 - No Internal Connection

Pin 7 - Grid No.2

Pin 8 - Grid No.1

Pin 9 - Same as Pin 1

Pin 10 - Grid No.2

Pin 11 - Filament

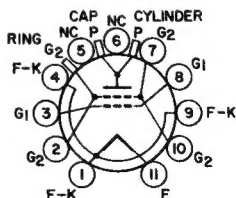
Cap - Plate-Terminal Connection

Cylinder - Plate-Terminal

Contact Surface

Ring^e - Grid No.2 Terminal

Contact Surface



Thermal:

Terminal Temperature

(All Terminals). 250 max. °C

Plate Core Temperature (See

Dimensional Outline) 250 max. °C

Cooling, Conduction:

The plate terminal must be thermally coupled to a constant temperature device (heat sink—solid or liquid) to limit the plate terminal temperature to the specified maximum value of 250° C. The grid-No.2, grid-No.1, and filament terminals may also require coupling to the heat sink to limit their respective terminal temperature to the specified maximum value of 250° C.

LINEAR RF POWER AMPLIFIER**Single-Sideband Suppressed-Carrier Service**

Peak envelope conditions for a signal having a minimum peak-to-average power ratio of 2

Maximum CCS Ratings, Absolute-Maximum Values:*Up to 500 Mc*

| | | |
|--|-----------------------|-------|
| DC Plate Voltage. | 2200 max. | volts |
| DC Grid-No.2 Voltage. | 400 max. | volts |
| DC Grid-No.1 Voltage. | -100 max. | volts |
| DC Plate Current at Peak of Envelope | 450 ^f max. | ma |
| DC Grid-No.1 Current. | 100 max. | ma |
| Plate Dissipation | 100 ^g max. | watts |
| Grid No.2 Input | 8 max. | watts |

Typical CCS Operation with "Two-Tone Modulation":*At 30 Mc*

| | | |
|--|------------------|-------|
| DC Plate Voltage. | 700 | volts |
| DC Grid-No.2 Voltage ^h | 250 | volts |
| DC Grid-No.1 Voltage ^h | -20 | volts |
| Zero-Signal DC Plate Current. | 100 | ma |
| Effective RF Load Resistance. | 1420 | ohms |
| DC Plate Current at Peak of Envelope | 205 | ma |
| Average DC Plate Current. | 150 | ma |
| DC Grid-No.2 Current at Peak of Envelope. | 16 | ma |
| Average DC Grid-No.2 Current. | 10 | ma |
| Average DC Grid-No.1 Current. | 1.0 ^j | ma |
| Peak-Envelope Driver Power Output (Approx.) ^k | 0.3 | watt |
| Output-Circuit Efficiency (Approx.) | 95 | % |
| Distortion Products Level: ^m | | |
| Third order | 30 | db |
| Fifth order | 35 | db |
| Useful Power Output (Approx.): | | |
| Average | 40 ⁿ | watts |
| Peak envelope | 80 ⁿ | watts |



Maximum Circuit Values:

Grid-No.1-Circuit Resistance

Under Any Condition:

With fixed bias. 25000 max. ohms

With fixed bias (In Class AB₁ operation) 100000 max. ohms

With cathode bias. Not recommended

Grid-No.2 Circuit Impedance. 10000 ohms

Plate Circuit Impedance. ^p**RF POWER AMPLIFIER & OSCILLATOR — Class C Telegraphy
and****RF POWER AMPLIFIER — Class C FM Telephony****Maximum CCS Ratings, Absolute-Maximum Values:***Up to 500 Mc*

| | | | |
|-------------------------------|------------------|------|-------|
| DC Plate Voltage. | 2200 | max. | volts |
| DC Grid-No.2 Voltage. | 400 | max. | volts |
| DC Grid-No.1 Voltage. | -100 | max. | volts |
| DC Plate Current. | 300 | max. | ma |
| DC Grid-No.1 Current. | 100 | max. | ma |
| Grid-No.2 Input | 8 | max. | watts |
| Plate Dissipation | 100 ^g | max. | watts |

Typical CCS Operation:*In Grid-Drive Circuit at 50 Mc*

| | | | |
|--|-----------------|------------------|-------|
| DC Plate Voltage. | 500 | 700 | volts |
| DC Grid-No.2 Voltage. | 160 | 175 | volts |
| DC Grid-No.1 Voltage. | -10 | -10 | volts |
| DC Plate Current. | 300 | 300 | ma |
| DC Grid-No.2 Current. | 25 | 25 | ma |
| DC Grid-No.1 Current. | 50 | 50 | ma |
| Driver Power Output (Approx.) ^q | 1.2 | 1.2 | watts |
| Useful Power Output | 85 ⁿ | 110 ⁿ | watts |

In Grid-Drive Circuit at 175 Mc

| | | | |
|--|-----------------|------------------|-------|
| DC Plate Voltage. | 500 | 700 | volts |
| DC Grid-No.2 Voltage. | 200 | 200 | volts |
| DC Grid-No.1 Voltage. | -30 | -30 | volts |
| DC Plate Current. | 300 | 300 | ma |
| DC Grid-No.2 Current. | 30 | 20 | ma |
| DC Grid-No.1 Current. | 40 | 40 | ma |
| Driver Power Output (Approx.) ^q | 3 | 3 | watts |
| Useful Power Output | 70 ⁿ | 105 ⁿ | watts |

In Grid-Drive Circuit at 470 Mc

| | | |
|-------------------------------|-----|-------|
| DC Plate Voltage. | 700 | volts |
| DC Grid-No.2 Voltage. | 200 | volts |
| DC Grid-No.1 Voltage. | -30 | volts |
| DC Plate Current. | 300 | ma |
| DC Grid-No.2 Current. | 10 | ma |
| DC Grid-No.1 Current. | 20 | ma |



In Grid-Drive Circuit at 470 Mc

| | | |
|--|-----------------|-------|
| Driver Power Output (Approx.) ^a | 5 | watts |
| Useful Power Output | 85 ⁿ | watts |

Maximum Circuit Values:**Grid-No.1-Circuit Resistance**

Under Any Condition:

With fixed bias 25000 max. ohms

Grid-No.2 Circuit Impedance 10000 max. ohms

Plate Circuit Impedance ^p

^a The heating time required for adequate cathode emission is a function of the filament voltage and the impedance of the filament-voltage supply. It may be drastically reduced by employing a suitably designed overvoltage control circuit.

^b Measured with special shield adapter.

^c E.F. Johnson Co., 1921 10th Ave. S.W., Waseka, Minnesota.

^d Mycalex Corp. of America, 125 Clifton Blvd. Clifton, N.J.

^e For use at higher frequencies.

^f The maximum rating for a signal having a minimum peak-to-average power ratio less than 2, such as is obtained in "Single-Tone" operation, is 300 ma. During short periods of circuit adjustment under "Single-Tone" conditions, the average plate current may be as high as 450 ma.

^g Maximum plate dissipation is limited by the maximum plate core temperature and the cooling system to maintain tube operation below the specified maximum plate core temperature. With simple low-cost cooling techniques, maximum plate dissipation may be only about 100 watts; with more sophisticated cooling techniques, maximum plate dissipation may be as high as 300 watts.

^h Obtained preferably from a separate well-regulated source.

^j This value represents the approximate grid-No.1 current obtained due to initial electron velocities and contact-potential effects when grid-No.1 is driven to zero volts at maximum signal.

^k Driver power output represents circuit losses and is the actual power measured at input to grid-No.1 circuit. The actual power required depends on the operating frequency and the circuit used. The tube driving power is approximately zero watts.

^m Referenced to either of the two tones, and without the use of feedback to enhance linearity.

ⁿ This value of useful power is measured at load of output circuit.

^p The tube should see an effective plate supply impedance which limits the peak-current through the tube under surge conditions to 15 amperes.

^q Driver power output includes circuit losses and is the actual power measured at the input to the grid circuit. It will vary depending upon the frequency of operation and the circuit used.

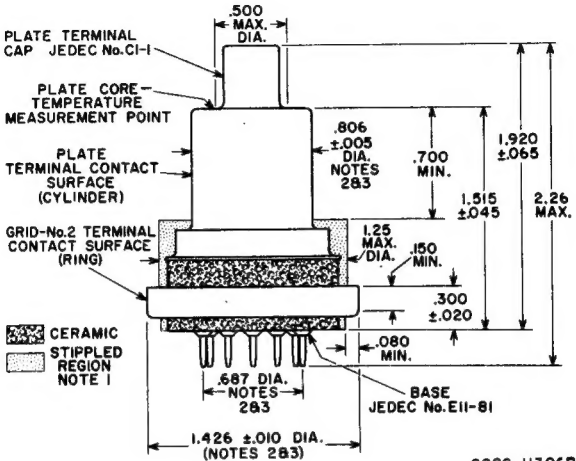
CHARACTERISTICS RANGE VALUES

| | Note | Min. | Max. | |
|--|------|------|------|-------|
| 1. Filament Current. | 1 | 3.6 | 5.6 | amp |
| 2. Direct Interelectrode Capacitances: | | | | |
| Grid No.1 to plate. | 2 | — | 0.13 | pf |
| Grid No.1 to cathode. | 2 | 14 | 18.5 | pf |
| Plate to cathode. | 2 | — | 0.03 | pf |
| Grid No.1 to grid No.2. | 2 | 18 | 24 | pf |
| Grid No.2 to plate. | 2 | 5.7 | 8.0 | pf |
| Grid No.2 to cathode. | 2 | 2.0 | 4.0 | pf |
| 3. Grid-No.1 Voltage | 1,3 | -6 | -24 | volts |
| 4. Grid-No.2 Current | 1,3 | -7 | +8 | ma |

Note 1: With 2.9 volts (AC or DC) on filament.

Note 2: Measured with special shield adapter.

Note 3: With dc plate voltage of 700 volts, dc grid-No.2 voltage of 250 volts, and dc grid-No.1 voltage adjusted to give a dc plate current of 185 ma.



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DIMENSIONS IN INCHES

Note 1: Keep all stippled regions clear. Do not allow contacts or circuit components to protrude into these annular volumes.

Note 2: The diameters of the plate terminal contact surface, grid-No.2 terminal contact surface, and pin circle to be concentric within the following values of maximum full indicator reading:

| | |
|--|--------|
| Plate terminal contact surface | |
| to grid-No.2 terminal contact surface. | 0.030" |
| Plate terminal contact surface | |
| to pin circle. | 0.040" |
| Grid-No.2 terminal contact surface | |
| to pin circle. | 0.030" |

Note 3: The full indicator reading is the maximum deviation in radial position of a surface when the tube is completely rotated about the center of the reference surface. It is a measure of the total effect of run-out and ellipticity.

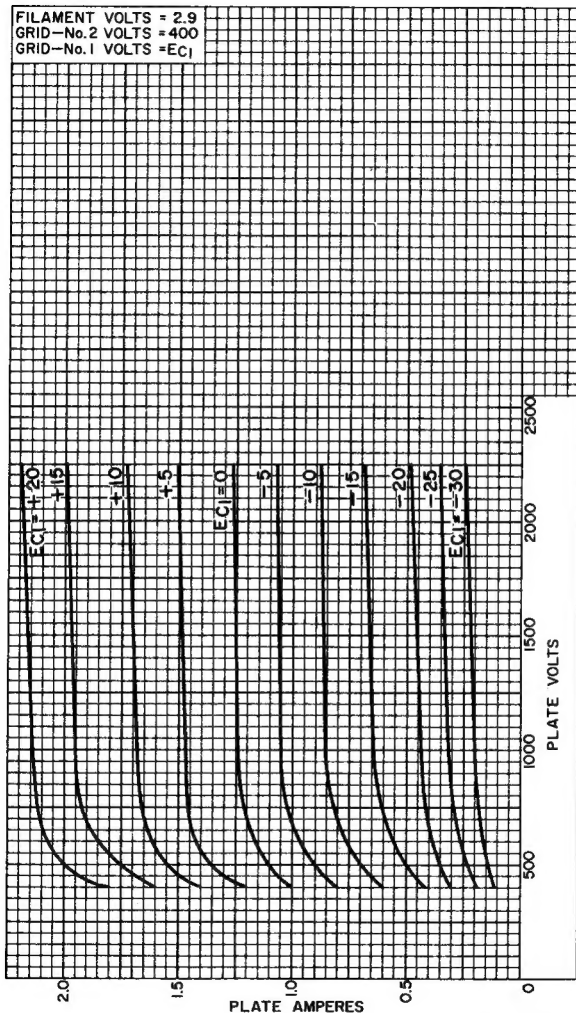


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TYPICAL PLATE CHARACTERISTICS

At a Constant Grid-No.2 Voltage of 400 Volts

FILAMENT VOLTS = 2.9
GRID-No.2 VOLTS = 400
GRID-No.1 VOLTS = E_{C1}



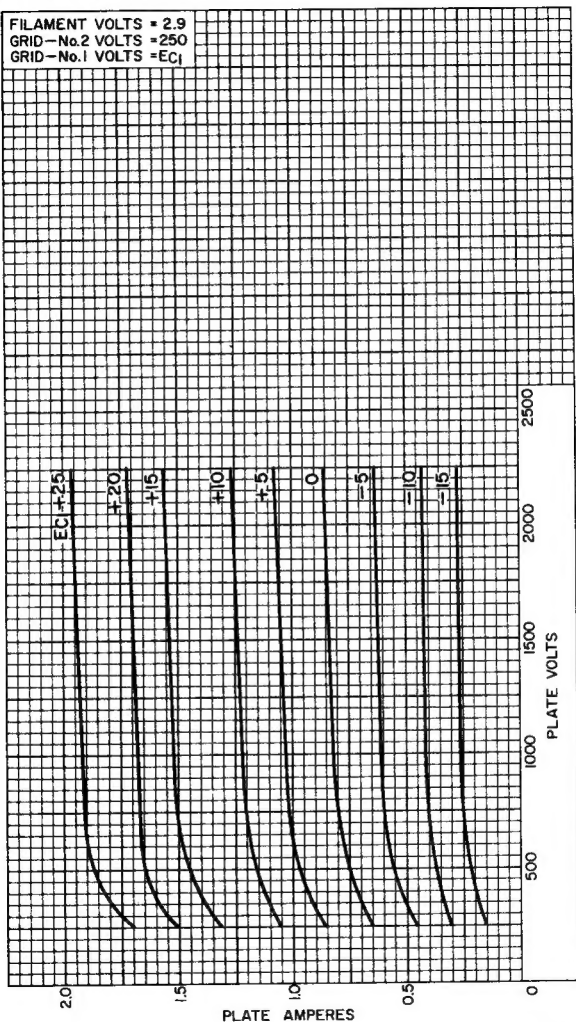
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TYPICAL PLATE CHARACTERISTICS

At a Constant Grid-No.2 Voltage of 250 Volts

FILAMENT VOLTS = 2.9
GRID-No.2 VOLTS = 250
GRID-No.1 VOLTS = E_{C1}



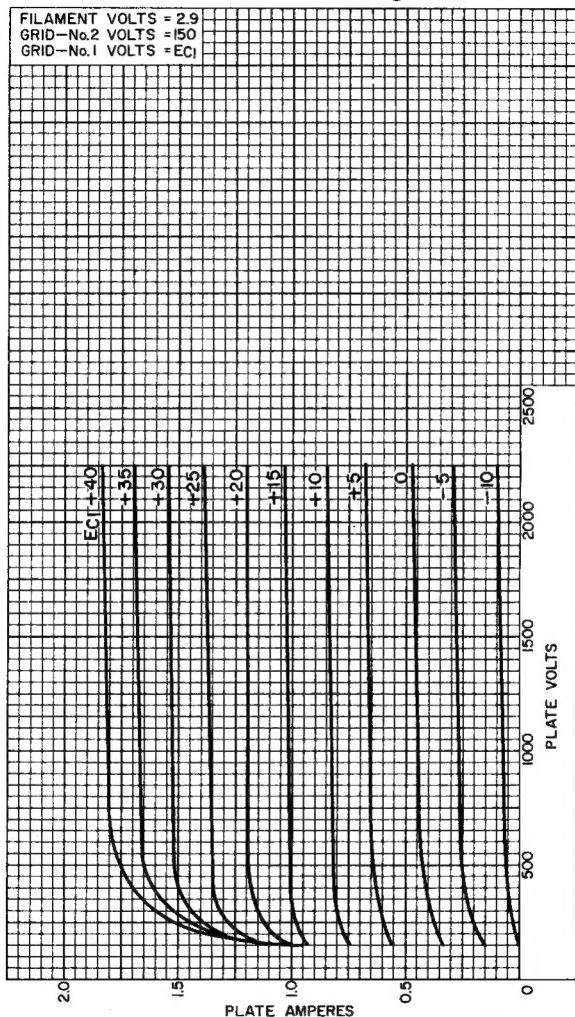
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TYPICAL PLATE CHARACTERISTICS

At a Constant Grid-No.2 Voltage of 150 Volts

FILAMENT VOLTS = 2.9
GRID-No.2 VOLTS = 150
GRID-No.1 VOLTS = E_C



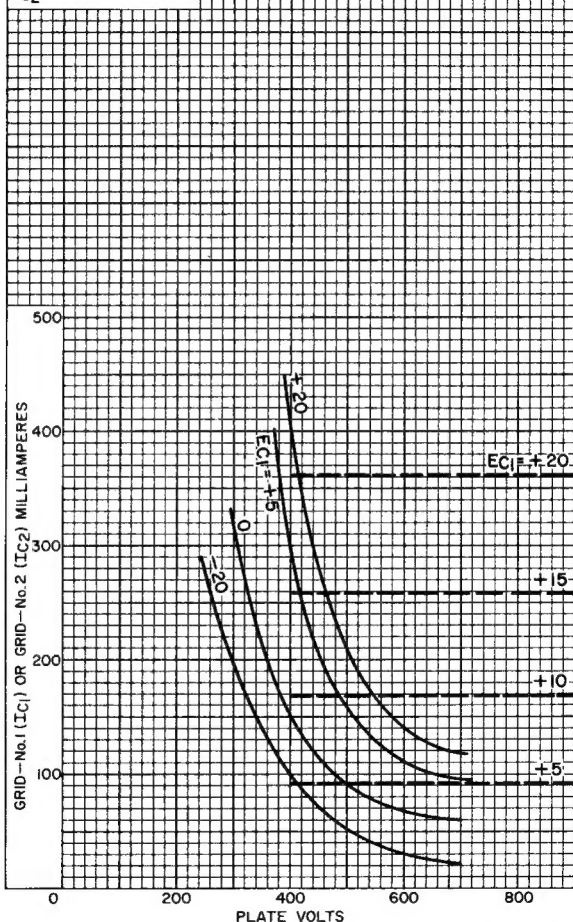
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TYPICAL CHARACTERISTICS

At a Constant Grid-No.2 Voltage of 400 Volts

FILAMENT VOLTS = 2.9
 GRID—No. 2 VOLTS = 400
 GRID—No. 1 VOLTS = E_{C1}
 I_{C1} = _____
 I_{C2} = _____

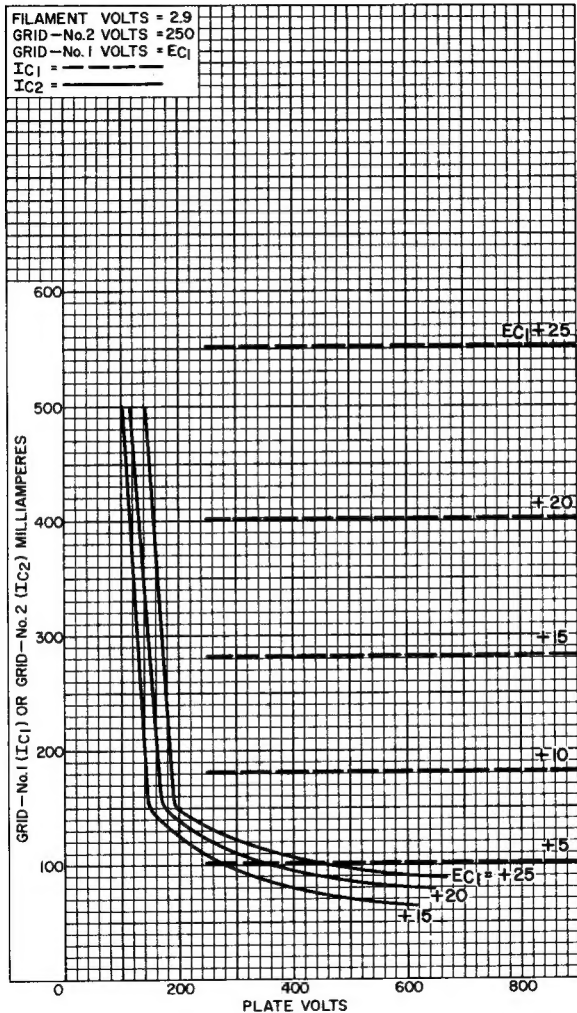


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TYPICAL CHARACTERISTICS

At a Constant Grid-No.2 Voltage of 250 Volts

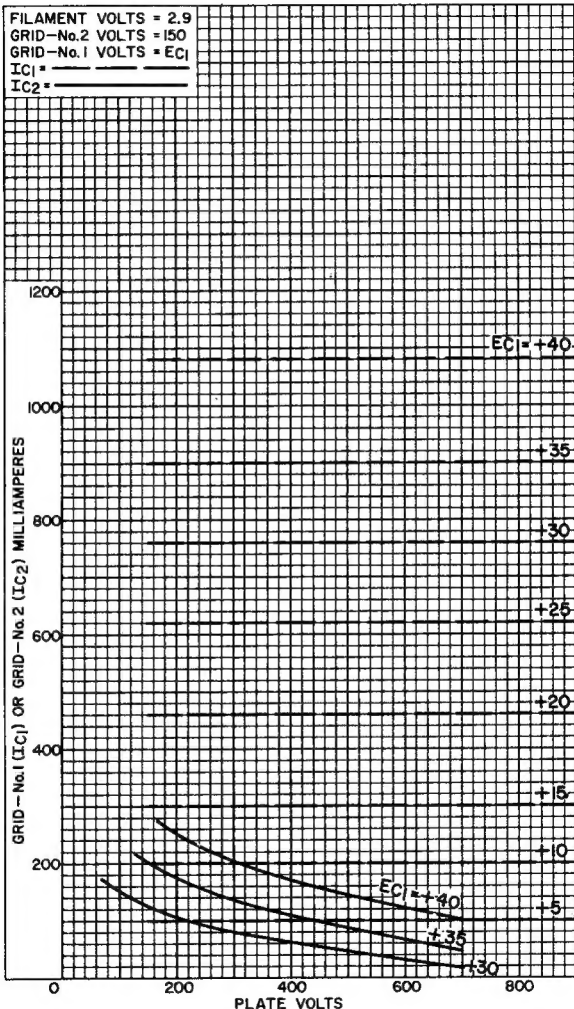


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TYPICAL CHARACTERISTICS

At a Constant Grid-No.2 Voltage of 150 Volts

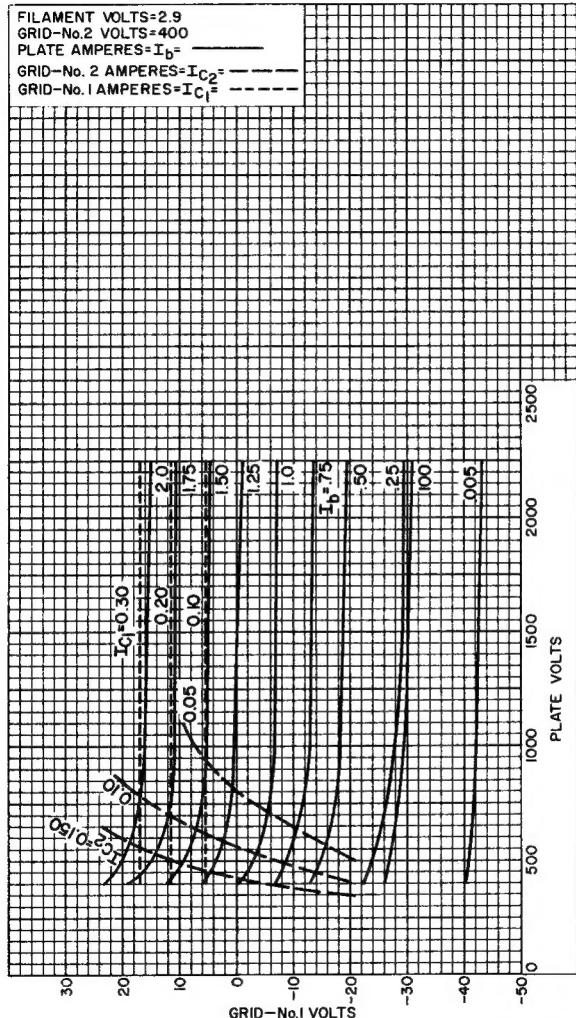


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TYPICAL CONSTANT-CURRENT CHARACTERISTICS At a Constant Grid-No.2 Voltage of 400 Volts

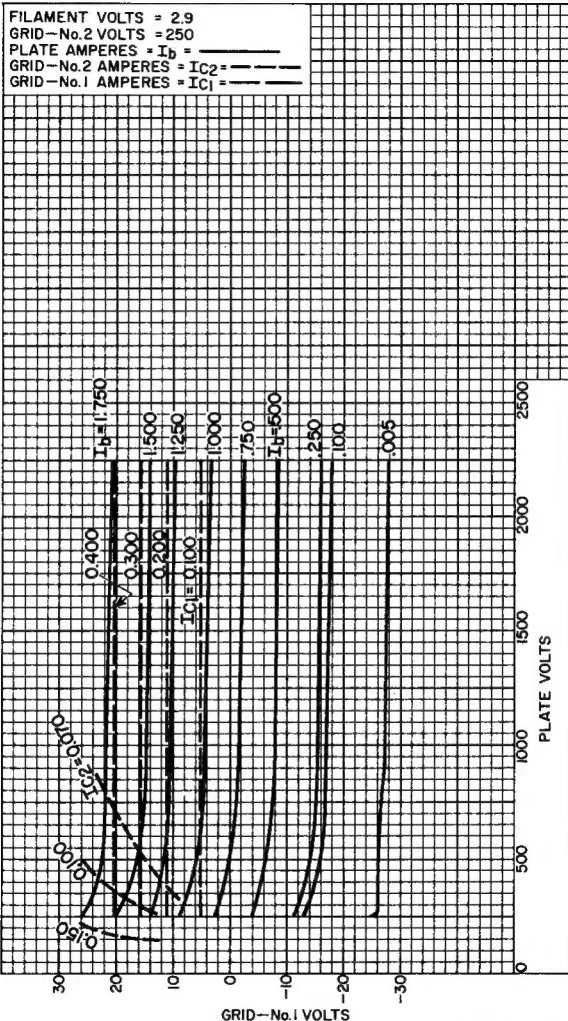


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TYPICAL CONSTANT-CURRENT CHARACTERISTICS

At a Constant Grid-No.2 Voltage of 250 Volts



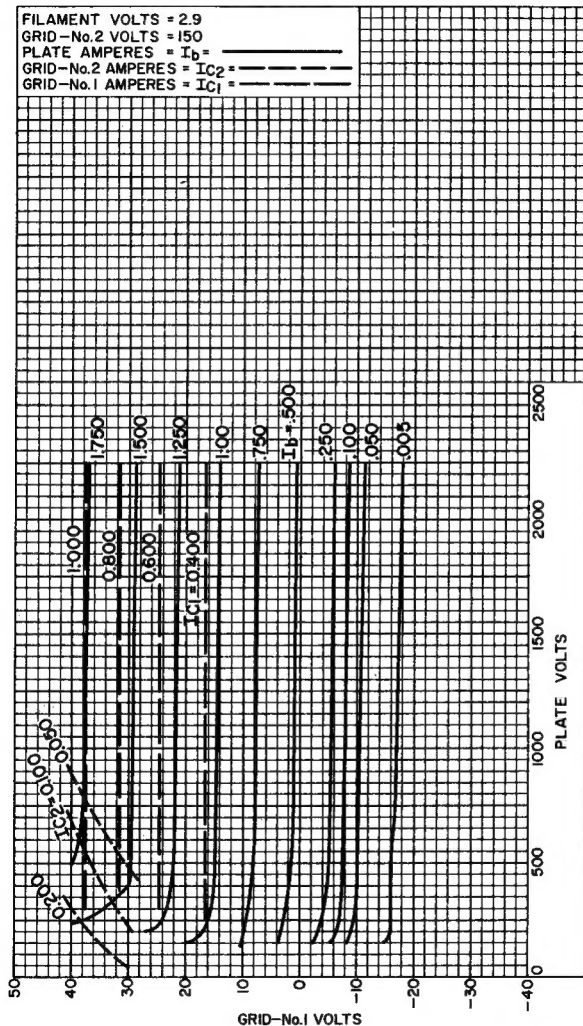
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TYPICAL CONSTANT-CURRENT CHARACTERISTICS

At a Constant Grid-No.2 Voltage of 150 Volts



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